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THE ROLE OF ADMINISTRATION OF SALT AND WATER IN TREATMENT OF CONGESTIVE HEART FAILURE

Important advances have been made in the treatment of congestive heart failure in the past thirty years, due, first, to the proper use of digitalis and allied drugs, secondly, to the introduction of various diuretics, especially the organic mercurials, and, finally, to a better appreciation of the importance of restriction of salt in the therapy of this disorder.

Although the underlying cause of congestive heart failure is probably a decrease in cardiac output relative to the metabolic demands of the body, the signs and symptoms of this condition are largely the result of an increase in the volume of extracellular fluid. Therapeutic measures fall into two groups. The first group includes those measures which primarily increase the relative cardiac output, such as rest and digitalis. Rest decreases the metabolic demand. Digitalis directly increases the cardiac output. Both measures secondarily cause a decrease in the volume of extracellular fluid through some mechanism which is not completely understood. The second group consists of those measures which primarily decrease the volume of extracellular fluid without affecting the cardiac output to any extent; this results from an output of sodium chloride which exceeds its intake. Restriction of salt is one of the most important measures of this latter group, so it is important to understand something of the relation of intake of salt and water to the control of the extracellular fluid volume.

Normal extracellular fluid is a solution of electrolytes, principally sodium chloride, in water, the concentration of which is maintained at a constant level. Edema fluid maintains the same salt concentration as does normal extracellular fluid. Thus, it is evident that as long as the electrolyte concentration remains at fixed levels water cannot leave or enter the extracellular compartment without a proportionate shift in salt. A number of mechanisms by which the volume of extracellular fluid may be increased are associated with the retention of salt and water. An increase in the volume of extracellular fluid results from lowered osmotic pressure of the blood in the presence of low serum proteins, as in nutritional edema, or from elevated capillary pressure caused by increased pressure in the veins. Water and salt are retained in these instances secondary to the increase in the volume of the extracellular fluid. On the other hand, retention of salt and water may be the primary factor and, secondarily, cause an increase in extracellular fluid, as may occur in the presence of renal disease or hormonal influences on renal function. Thus edema fluid cannot be formed without the retention of salt and water, and likewise it cannot be lost without the loss of salt and water.

A considerable body of experimental and clinical observation indicates the relation of salt and water to the formation of the edema fluid of congestive heart failure, although there is some controversy concerning the exact mechanism involved in its production. "Compensated" cardiac patients may fail, that is, develop congestion and edema when fed amounts of salt (6 to 15 gm. a day) which are tolerated by normal people. Conversely, "decompensated" cardiac patients may improve or lose their congestion entirely when their intake of salt is reduced to low levels (1.5 to 2.0 gm. a day). The results of these studies are not significantly altered by increasing or decreasing the intake of fluid. That it is sodium rather than chloride which is of importance is demonstrated by the fact that chloride given in the absence of sodium, as in potassium or ammonium salts, acts as a diuretic, whereas sodium given in the absence of chloride, as in sodium bicarbonate, acts similarly to common salt. Studies have shown also that cardiac patients retain larger quantities of the amount of sodium chloride ingested than do normal people.

Similar observations on the administration of water to patients with congestive heart failure indicate that it has a much less important role in the production of the increased volume of extracellular fluid. In the presence of a low intake of salt (1.0 to 2.0 gm. a day) fluids may be forced to as much as 6 liters a day in patients with cardiac decompensation without increasing their congestion and often without altering the diuresis expected from the low intake of sodium. On the other hand, restriction of fluids to 1,000 c.c. a day does not cause diuresis in the presence of a moderate intake of salt and does not increase the diuresis caused by a low intake of salt.

In these studies the retention of salt appears to be the primary cause of the retention of water which secondarily results in an increase in the volume of extracellular fluid. Why the cardiac patient fails to excrete sodium chloride in a normal manner is not clear, though there is considerable evidence to indicate that the retention is primarily renal, possibly associated with decreased renal blood flow. This does not necessarily imply that, under different conditions, other mechanisms, in which the retention of extracellular fluid is primary and retention of salt and water secondary, may not also be active. Whatever mechanisms are involved in the production of the congestion of heart failure, the observations just noted indicate that sodium has an important place in its regulation.

The foregoing observations and discussion demonstrate the importance of restriction of salt and the relative unimportance of restriction of fluid in the treatment of congestive heart failure. For many years it has been a general practice to restrict fluids for patients with congestive heart failure while also

restricting their intake of salt to a greater or lesser extent. There is no experimental or clinical evidence that this restriction of fluid is of benefit, and the following consideration suggests that such restriction may even be harmful to the patient. An adequate urinary output cannot be maintained in the presence of great restriction of fluid, a factor which is of special importance in cases in which renal function is already disturbed, as is often true in the presence of congestive heart failure. On the other hand, the forcing of a large intake of fluid up to 6 liters a day, while generally not harmful to the cardiac patient in congestive failure, provided the intake of sodium is low, has not been proved to be beneficial. Such an intake of fluid often causes the patient great discomfort. Therefore, until experimental and clinical evidence establishes the optimal intake of fluid for patients with congestive heart failure, an intake of 2 or 3 liters a day would seem to be adequate.

The importance of careful restriction of salt has frequently been neglected in the past, though evidence of its importance was observed more than forty years ago. Slight to moderate restriction has been the general practice. Since it has been demonstrated that sodium is the important substance to restrict, it is essential to know the sources of sodium in the average diet. Salt added to food during its preparation, that is, cooking, canning, preserving, flavoring, and so forth, is much the largest source of sodium. Of unprepared foods milk is the largest source. The comparative amounts of salt contained in diets, which vary in degree of salt restriction, are as follows: (1) average diet, without restriction of salt, 6 to 15 gm.; (2) average diet, without salt added at table, 4 to 7 gm.; (3) average diet, without salt added in cooking, 3 to 4 gm.; and (4) "low sodium diet" 1.0 to 2.0 gm. The difference in the salt content between the last two diets is largely due to the use in the low sodium diet of salt free bread and butter and restriction to 1 pint (500 c.c.) of milk. Not all patients with congestive heart failure require severe restriction of salt; indeed, many patients with mild failure may be able to get along without any decrease in intake of salt. Other patients will need the minor degrees of restriction just mentioned while only a few with severe chronic congestive failure will require a "low sodium diet." Since the preparation of such a diet in the home involves considerable trouble and the patients usually object to the flat taste of the food, it should not be recommended indiscriminately. It may be used with especial benefit when congestion is uncontrolled by other means or when the frequent use of mercurial diuretics has become distressing.

Patients who are expected to follow a "low sodium diet" should be given careful written instructions advising them what they may or may not eat and drink. It may be helpful also to provide the patient with a recipe for salt free bread. The following list of instructions insures a relatively low sodium intake.

LOW SODIUM DIET

FOODS ALLOWED

1. Meat, boiled fish, or poultry prepared and served without salt.
2. Egg—one daily.
3. Milk—limited to 2 glasses (1 pint).
4. Vegetables—(as desired) any fresh or frozen vegetables except lima beans, prepared and served without salt.
5. Fruits—(as desired) fresh, canned, stewed.
6. Breads—only yeast bread prepared without salt.
7. Cereals—any cooked cereal prepared without salt. The only dry prepared cereals allowed are: puffed rice, puffed wheat, shredded wheat, and "Muffets."
8. Potatoes and rice, prepared without salt. Macaroni, spaghetti and noodles contain salt and are not to be used.
9. Butter—unsalted or "washed" butter.
10. Desserts—custards, junkets, and plain puddings made with milk allowance and with no added salt; jello; pies with no salt added to the crust and filling prepared with fresh or canned fruit (no meringues).
11. Beverages—tea, coffee, carbonated drinks or fruit juices.
12. Flavorings—cocoa, chocolate, caramel, maple, peppermint, lemon, orange, vanilla, maraschino cherries, cloves, cinnamon, allspice, nutmeg, ginger, and coffee.
13. Seasonings—pepper (black or red), curry, dry mustard, mint, dill, vinegar, parsley, paprika, sage, thyme, onion, garlic, pimiento, rosemary.
14. Sweets—white or brown sugar, honey, molasses, jellies, jams, marmalade, or preserves which do not contain sodium benzoate.

SPECIAL INSTRUCTIONS

1. No salt is to be used in preparation of food or in cooking or to be added to the food after it comes to the table.
2. Avoid all canned foods which have salt added, such as canned meats and fish, vegetables, soups, tomato juice and V-8 cocktail.
3. Avoid all brine-cured and smoked foods, such as bacon, ham, pickles, or smoked fish, meat or sausages, and olives.
4. Omit all salty foods, such as salted nuts, potato chips, and buttered or salted popcorn.
5. The following food accessories are also to be omitted because of their salt content: meat extracts and sauces, chili sauce, catsup, mustard, and relishes.
6. Do not use any cheese, clams, oysters, lobsters.
7. Use only yeast breads prepared without salt.
8. Use no foods prepared with baking soda or baking powder, such as soda crackers, biscuits, muffins, cakes and cookies.
9. Use only unsalted or "washed" butter. Sweet butter may have salt added, so be sure to read the label before using it.
10. Home-made mayonnaise may be used, if prepared without salt.
11. Avoid dried fruits, such as figs, dates, raisins, apricots, and prunes.
12. Avoid lima beans, fresh or dried.
13. Sodium-containing medicines, such as soda bicarbonate, soda mints, tums, alka-seltzer, and various indigestion powders should not be used. Salt gargles and toothpastes containing sodium likewise are forbidden.

RECIPE FOR SALT FREE BREAD

6½ lbs. bread floor
10 oz. sugar
8 oz. shortening (Primox)
4 oz. yeast
2 qt. water

This makes six loaves. Apparently this bread takes a little longer to rise than ordinary bread.

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